APPENDIX

[illegible] analysis for the effects of the [illegible]

[illegible] sensitivity analysis

Expenditure	NPV
[illegible]	[illegible]
[illegible]	[illegible]
-10%	[illegible]
[illegible]	[illegible]

[illegible] and expenditures, and the [illegible] [illegible] the revenue and the construction [illegible] and [illegible] adjusting the [illegible] of [illegible] the construction [illegible] expenditure [illegible]

[illegible]

1. EMERGENCY PLAN

1-1 Viewpoint of Plan

Emergency plan shown here was prepared with the following background: For short-term development plan, B of the two alternatives was chosen, as indicated in Chapter 7. Views had been frequently exchanged between the ENAPU and the study team before this plan was adopted. The short-term development plan selected is designed to cope with the subject of handling container cargoes and grains at Callao Port. A considerable investment is necessary to accomplish this plan. From the view-point of fund raising, the amount of this investment is unprecedentedly large to the ENAPU. Raising the fund may be made difficult by external factors even if the project is financially viable. For this reason, the ENAPU, in discussing the interim report, asked the study team to take steps including the proposal of an emergency plan to reduce construction costs (review of construction methods and unit prices). Whereupon, the study team first studied to reduce construction costs. But it was found that cost retrenchment by only several percent could be expected for the construction costs as of the time of the interim report. So, the study team next studied to curtail the scale of the plan. What is most important is decision as to which should be constructed with top priority, container facilities or grain facilities.

The study team has decided that it is the container wharf that should first be constructed and set the essentials of the emergency plan as follows:

1) It is container-related facilities that should be constructed.
2) The construction of the grain wharf will be the next plan and the same sea area will be used for this purpose as at present.
3) Study will be made to improve management methods so as to increase the grain handling capacity at existing facilities.
4) Wharf No. 9 will remain in existence, if possible.
5) Since space for container keeping proposed for the rear of the grain wharf cannot be secured, management efforts will be made to bring empty containers out of the port whenever this is possible.
6) Construction costs will be reduced in consideration of construction methods and improvement levels.
7) The emergency plan should be so devised as to permit smooth shift in the execution of the master plan and the short-term development plan.

This emergency plan should be regarded as Phase I of the short-term development plan and the short-term development plan should follow in its wake. (see Fig. 1-1)

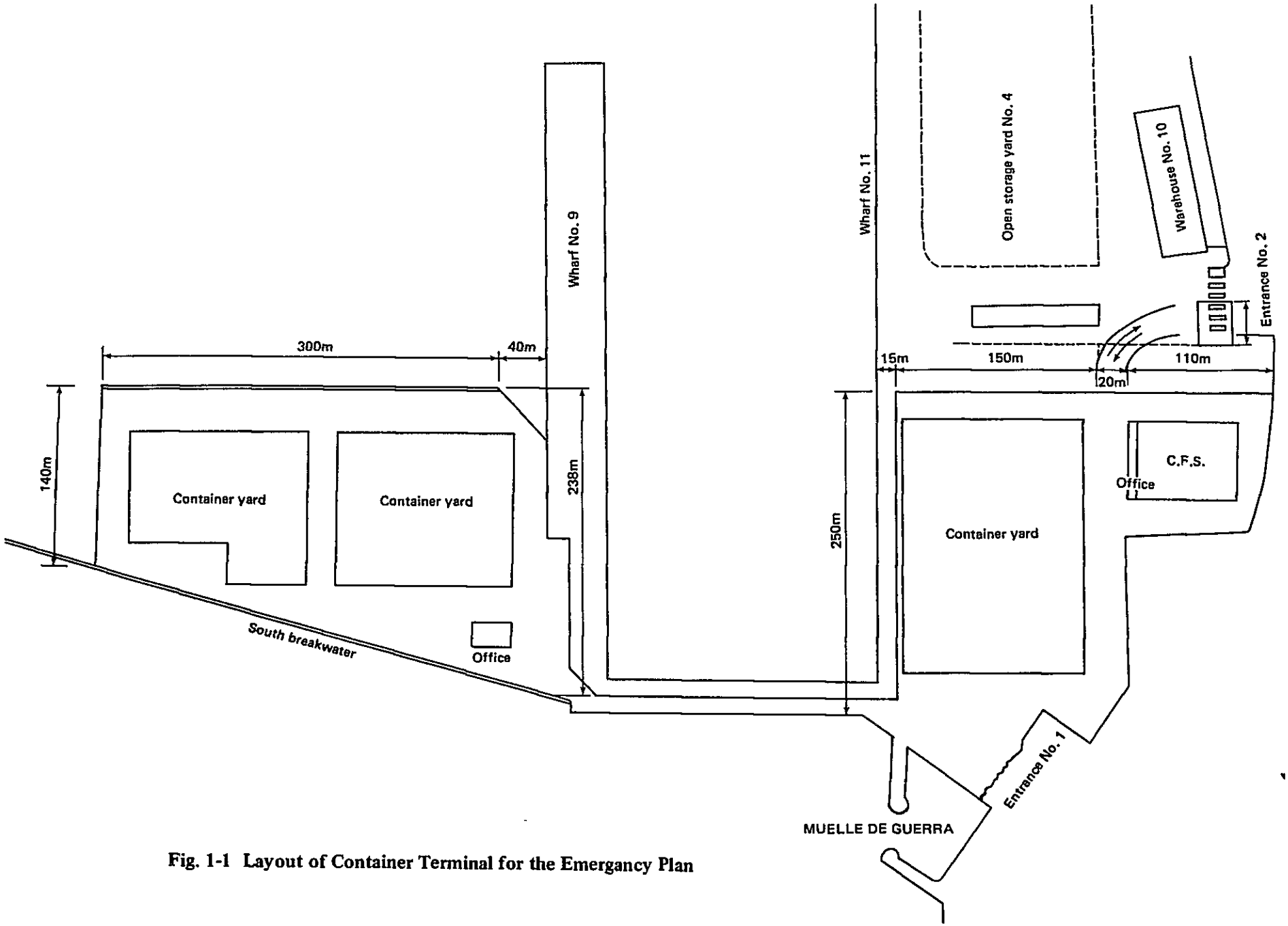


Fig. 1-1 Layout of Container Terminal for the Emergancy Plan

1-2 Project Cost and Construction Schedule

Table 1-1 shows the total cost required for the construction in the emergency plan. Construction period will be about 3 years and 2 months as shown in Fig. 1-2.

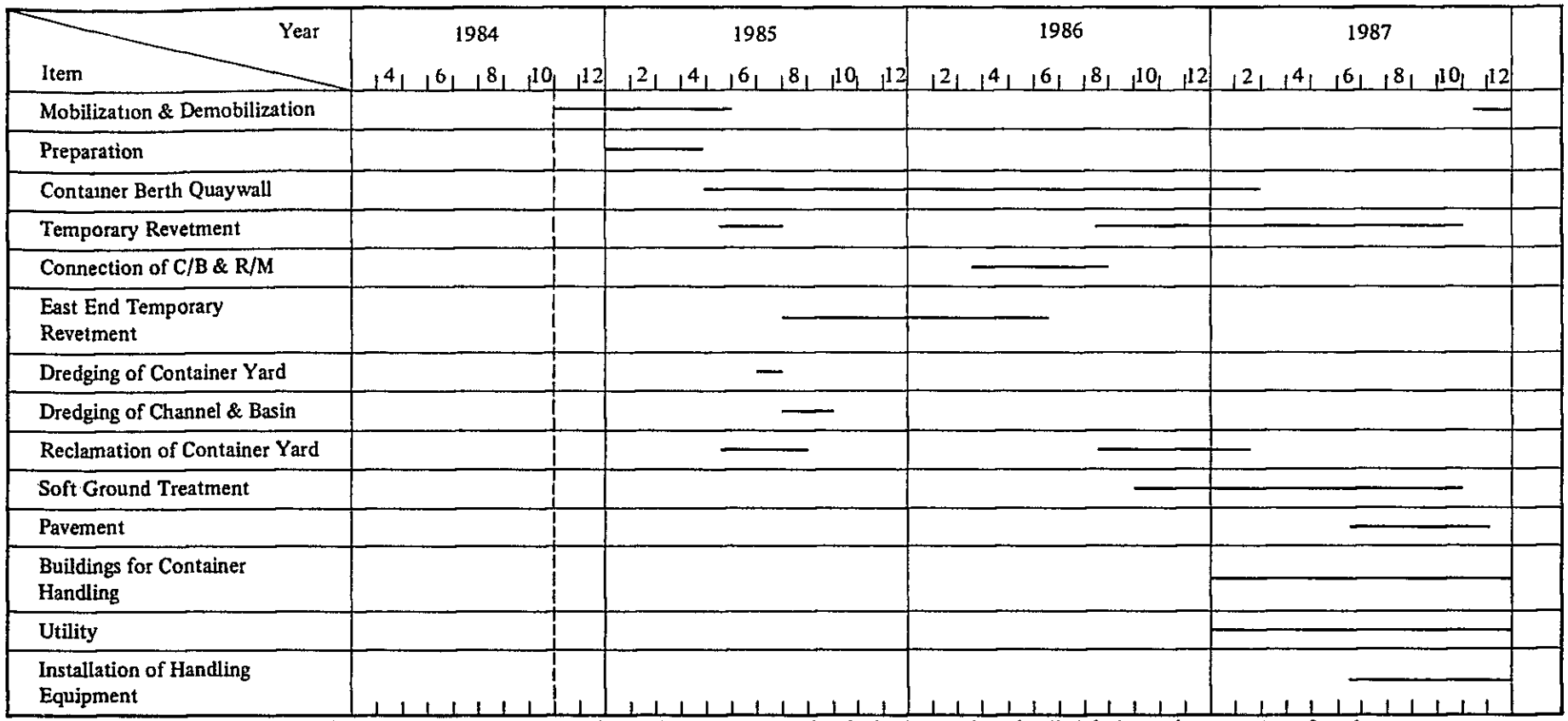
Table 1-1 Construction Cost of Emergency Plan

(Unit: 1,000 US$)

Item	Unit	Quantity	Amount		
			Foreign	Local	Sib-Total
Mobilization & Demobilization	L.S.	1	7,637	–	7,637
Preparation	L.S.	1	1,981	1,304	3,285
Container Berth Quaywall	m	300	6,127	1,693	7,820
Temporary Revetment	m	* 515	1,516	1,539	3,055
Connection of C/B & R/M	m	20	215	30	245
East End Temporary Revetment	m	160	1,756	408	2,164
Dredging of Container Yard	m^3	227,000	571	77	648
Dredging of Channel & Basin	m^3	494,400	907	137	1,044
Reclamation of Container Yard	m^3	1,064,800	3,631	765	4,396
Soft Ground Treatment	m^2	11,250	229	80	309
Pavement	m^2	118,400	350	3,099	4,449
Buildings for Container Handling	L.S.	1	–	2,148	2,148
Utility	L.S.	1	1,508	642	2,150
Handling Equipments	L.S.	1	13,525	–	13,525
Engineering Service			1,719	925	2,644
Contingency			3,495	1,938	5,433
Total			45,167	15,785	60,952

* Including reinforcement of south breakwater.

Fig. 1-2 Construction Schedule of Emergency Plan



Note: Assuming that tendering for construction needs 3 months, engineering services for the Project such as detailed design and preparation of tender documents must start at least 12 months before commencement of construction work

1-3 Economic Analysis

This study is to discuss the economic efficiency of the project which includes (1) reclamation inside the south breakwater, (2) construction of a container berth (3) construction of land facilities and cargo handling equipment, using internal rate of return (IRR).

1-3-1 Data used for the Economic Analysis

1-3-2 Period of economic calculation

Average useful life time of the facilities will be 15.4 years so the period of economic calculation (project life) is assumed as 15 years after the completion of the facilities.

1-3-3 Calculation and assessment of internal rate of return (IRR)

Table 1-16 shows flow of costs and benefits and IRR.

IRR is 27.73%.

According to Instituto National de Planification, Social Discount Rate in Peru is 15% and in the case of infrasector, 13% is used as supplement. Therefore, the project is considered feasible enough.

Table 1-2 Frame of Handled Cargo Volume (Container & General Cargo)

1. With

(Unit: 1,000 tons)

Cargo / Year	Callao (Container)	Callao (General Cargo)	San Martin (General Cargo)	Total
1984	367	2,150	99	2,616
1985	506	〃	94	2,750
1986	650	〃	92	2,892
1987	650	〃	241	3,041
1988	1,091	2,108	0	3,199
1989	1,328	2,037	0	3,365
1990	1,500	2,000	0	3,500
〃	〃	〃	〃	〃
〃	〃	〃	〃	〃
〃	〃	〃	〃	〃
2002	1,500	2,000	0	3,500

2. Without

(Unit: 1,000 tons)

Cargo / Year	Callao (Container)	Callao (General Cargo)	San Martin (General Cargo)	Total
1984	367	2,150	99	2,616
1985	506	〃	94	2,750
1986	550	〃	92	2,892
1987	〃	〃	241	3,041
1988	〃	〃	399	3,199
1989	〃	〃	565	3,365
1990	〃	〃	700	3,500
〃	〃	〃	〃	〃
〃	〃	〃	〃	〃
〃	〃	〃	〃	〃
2002	650	2,150	700	3,500

Table 1-3 Frame of Calling Vessels

1. With

Cargo / Year	Callao (Container)	Callao (General Cargo)	San Martin (General Cargo)
1984	113	1,070	49
1985	156	〃	47
1986	201	〃	46
1987	201	〃	120
1988	337	1,049	0
1989	410	1,014	0
1990	463	996	0
〃	〃	〃	〃
〃	〃	〃	〃
〃	〃	〃	〃
2002	463	996	0

2. Without

Cargo / Year	Callao (Container)	Callao (General Cargo)	San Martin (General Cargo)
1984	113	1,070	49
1985	156	〃	47
1986	201	〃	46
1987	〃	〃	120
1988	〃	〃	199
1989	〃	〃	281
1990	〃	〃	348
〃	〃	〃	〃
〃	〃	〃	〃
〃	〃	〃	〃
2002	201	1,070	348

Table 1-4 Average Ships' Waiting Time

(Unit: hours)

Ship Type / Year	Callao (Container)		Callao (General Cargo)		San Martin (General Cargo)	
	with	without	with	without	with	without
1984	19 8	19.8	61.8	61.8	0	0
1985	39.2	39.2	〃	〃	0	0
1986	20.0	20.0	〃	〃	0	0
1987	20.0	〃	〃	〃	0.8	0.8
1988	1.7	〃	44.0	〃	0	5.4
1989	2.7	〃	20.6	〃	〃	26.5
1990	3.7	〃	16.1	〃	〃	97.9
〃	〃	〃	〃	〃	〃	〃
〃	〃	〃	〃	〃	〃	〃
〃	〃	〃	〃	〃	〃	〃
2002	3.7	20.0	16.1	61.8	0	97.9

Table 1-5 Unit Direct Variable Cost in 1982

(Unit: dollars)

	Shipping Service (per ship)	Storage Service (per ton)	General Cargo Handling Service (per ton)
Labour Cost (ENAPU)	1,120.58	1.96	5.15
Labour Cost (CCT M)			31.22
Material Cost (ENAPU)	100.00		0.12
Outside Job Cost (ENAPU)	41.35	0.04	0.05
Total	1,261.83	2.00	36.54

Table 1-6 Unit Cost of Land Transportation

(Unit: US$/ ton)

Commodity type / Transportation Route	General Cargo	Container
Callao Port ~ Lima, Callao Area	5.13	10.93
San Martin Port ~ Lima, Callao Area	11.84	–

Table 1-7 Ships' Waiting Cost

(Unit: 1,000 US$)

Year	Callao (Container)			Callao (General Cargo)			San Martin (General Cargo)			Total
	with	without	With-Without	With	without	with-without	with	without	with-without	with-without (minus means benefit)
1984	169	169	0	4,141	4,141	0	0	0	0	0
1985	462	462	0	4,141	"	0	0	0	0	0
1986	304	304	0	4,141	"	0	0	0	0	0
1987	304	"	0	4,141	"	0	6	6	0	0
1988	43	"	-261	2,891	"	- 1,250	0	67	-67	-1,578
1989	184	"	-220	1,308	"	- 2,833	0	466	-466	-3,519
1990	130	"	-174	1,004	"	- 3,137	0	1,373	-1,373	-4,684
"	"	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	"	"	"	"
"	"	"	"	"	"	"	"	"	"	"
2002	130	304	174	1,004	4,141	-3,137	0	1,373	-1,373	-4,684

Table 1-8 Transportation Cost (General Cargo & Container, with-without)

Year	Callao Port				San Martin Port		Total Transportation Cost
	General Cargo		Container		General Cargo		
	Transportation Volume (Thousand tons)	Transportation Cost (Thousand US$)	Transportation Volume (Thousand tons)	Transportation Cost (Thousand US$)	Tranportation Volume (Thousand tons)	Transportation Cost (Thousand US$)	(Thousand US$)
1984	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0
1988	-43	-215	441	4,820	-399	-4,724	-119
1989	-113	580	678	7,411	-565	-6,690	141
1990	150	-770	850	9,291	-700	-8,288	233
2002	150	-770	850	9,291	-700	-8,288	233

Table 1-9 General Cargo Handling Cost

(Unit: 1,000 US$)

Year	Callao (General Cargo)			San Martin (General Cargo)			Total(-means benefit)
	with	without	with-without	with	without	with-without	with-without
1984	78,548	78,548	0	3,619	3,617	0	0
1985	78,548		0	3,434	3,434	0	0
1986	78,548		0	3,361	3,361	0	0
1987	78,548		0	8,805	8,805	0	0
1988	77,014		-1,534	0	14,577	-14,577	-16,111
1989	74,420		-4,128	0	20,642	-20,642	-24,770
1990	73,068		-5,480	0	25,574	-25,574	-31,054
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
2002	73,068	78,548	-5,480	0	25,574	-25,574	-31,054

Table 1-10 Container Cargo Handling Cost at Callao Port

(Unit: 1,000 US$)

Year	With			Without (5B Berth)	With-without (-means benefit)
	5B Berth	New Container Terminal	Total		
1984	860	0	860	860	0
1985	1,185	0	1,185	1,185	0
1986	1,523	0	1,523	1,523	0
1987	1,523	0	1,523		0
1988	1,108	9,551	10,659		9,136
1989	1,347	9,614	10,961		9,438
1990	1,523	9,661	11,184		9,661
⋮	⋮	⋮	⋮	⋮	⋮
2002	1,523	9,661	11,184	1,523	9,661

Table 1-11 Shipping Service Cost

Year	Unit Cost (dollars)	Ship Amount (Callao) with-without (Container Ship General Cargo Ship)	Shipping Service Cost (Callao) with-without (thousand US$)	Ship Amount (San Martin) with-without (General Cargo Ship)	Shipping Service Cost (San Martin) with-without (thousand US$)	Total Shipping Service Cost with-without (thousand US$) (minus means benefit)
1984	1,261.83	0	0	0	0	0
1985	↓	0	0	0	0	0
1986	↓	0	0	0	0	0
1987	↓	0	0	0	0	0
1988	↓	115	145	−199	−251	−106
1989	↓	153	193	−281	−355	−162
1990	↓	188	237	−348	−439	−202
↓	↓	↓	↓	↓	↓	↓
2002	1,261.83	188	237	−348	−439	−202

Table 1-12 Storage Service Cost (General Cargo)

Year	Callao				San Martin				Total Storage Service Cost (Thousand US$) with-without (minus means benefit)
	Indirect Cargo Volume (Thousand tons)			Storage Service Cost (Thousand US$)	Indirect Cargo Volume (Thousand tons)			Storage Service Cost (Thousand US$)	
	with	without	with-without	with-without	with	without	with-without	with-without	
1984	1,573	1,573	0	0	73	73	0	0	0
1985	↓	↓	0	0	69	69	0	0	0
1986	↓	↓	0	0	67	67	0	0	0
1987	↓	↓	0	0	177	177	0	0	0
1988	1,560	↓	-13	-26	0	292	-292	-584	-610
1989	1,510	↓	-63	-126	0	414	-414	-828	-954
1990	1,483	↓	-90	-180	0	512	-512	-1,024	-1,204
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
2002	1,483	1,573	-90	-180	0	512	-512	-1,024	-1,204

Table 1-13 Storage Service Cost at No. 5B Berth (Container)

Year	LCL Cargo Volume (thousand tons)			Storage Service Cost (Thousand US$) (minus means benefit)
	with	without	with-without	
1984	183.5	183.5	0	0
1985	253	253	0	0
1986	325	325	0	0
1987	325		0	0
1988	236.5		−88.5	−177
1989	287.5		−37.5	−75
1990	325		0	0
2002	325	325	0	0

Table 1-14 Total Benefit

(Unit: thousand US$)

Year	Ships' waiting cost	Land Transportation cost	Cargo handling cost		Shipping Service Cost	Storage service cost		Total Benefit
			General Cargo	Container		General Cargo	Container	
1984	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0
1988	-1,578	-119	-16,111	9,136	-106	-610	-177	-9,565
1989	-3,519	141	-24,770	9,438	-162	-954	-75	-19,901
1990	-4,684	233	-31,054	9,661	-202	-1,204	0	-27,250
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								
2000								
2001								
2002	-4,684	233	-31,054	9,661	-202	-1,204	0	-27,250

Table 1-15 Project Cost

(Unit: 1,000 US$)

Year	Project Cost
1984	2,589
1985	17,603
1986	10,144
1987	30,616
Total	60,952

Table 1-16 Costs/Benefits and IRR (Market Price)

Year	Costs (1,000 US$)	Benefits (1,000 US$)	Benefits-Costs (1,000 US$)	IRR 27.73 %
1984	2,589	0	−2,589	−2,589
1985	17,603	0	−17,603	−13,782
1986	10,144	0	−10,144	−6,218
1987	30,616	0	−30,616	−14,693
1988	0	9,565	9,565	3,593
1989	0	19,901	19,901	5,854
1990	0	27,250	27,250	6,275
1991	0	27,250	27,250	4,913
1992	0	27,250	27,250	3,846
1993	0	27,250	27,250	3,011
1994	0	27,250	27,250	2,358
1995	0	27,250	27,250	1,846
1996	0	27,250	27,250	1,445
1997	0	27,250	27,250	1,131
1998	0	27,250	27,250	886
1999	0	27,250	27,250	693
2000	0	27,250	27,250	543
2001	0	27,250	27,250	425
2002	0	37,967	37,967	463
Total	60,952	394,433	333,481	0

1-4 Financial Analysis

This main text analyzed 8 financial statements by adopting 4 types of sources and application of funds based on two types of operating expenses, i.e. A type which is the current operating expenses at the Callo Port and B type which is the current operating expenses at the Port plus 10% thereof.

In this analysis, 4 financial statements are analyzed by adopting two types of sources and application of funds by borrowing based on C type and D type which are added with 15% and 20% of A type. FRR based on the above two types of operating expenses will be obtained in order to judge the soundness of the project.

The main text analyzed the project related to the construction of container and grain berths. This paper further analyzes the soundness of the project by obtaining FRR by discount cash flow analysis for investment efficiency for the case limited to the construction of a container berth only.

1-4-1 Analysis of Financial Statements for 4 Cases

Tables 1-17, 1-18 and 1-19 are respectively the summarized Estimate Statement of Revenue Expenditure, Sources and Application of Fund and Balance Sheet for 4 cases.

The details of the 4 cases are as follows:

No.	Case	Borrowing Condition	Operating Expense
1	C3	(Foreign Currency) Loan from Foreign Bank: Interest 12% (Local Currency) Loan from Domestic Bank: Interest 17%	C Type (A Type plus 15% thereof)
2	C4	(Foreign Currency) Loan from Foreign Bank: Interest 4.25% (Local Currency) Loan from Domestic Bank: Interest 12%	– ditto –
3	D3	the Same as Case C3	D Type (A Type plus 20% thereof)
4	D4	the Same as Case C4	– ditto –

The analysis of the revenue and expenditure and raising of fund on 4 cases reveals that no problems will arise for all the cases in revenue and expenditure, but fund raising presents some problems. In the case of D3, the shortage of fund will have a considerable effect; the deficit in net current assets (current assets minus current liabilities) continues for three years, i.e. US$-10 million in 1988, US$-10 million in 1989 and US$-5 million in 1990. The project, therefore, should be judged not feasible. There are no such problems for other cases. The financial statements are analyzed for 4 cases based on E and F types of operating expenses that are 125% and 130% of that of A type respectively and by adopting aforementioned two types of fund raising conditions. It is disclosed that there will be deficits and shortage of funds in the revenue and expenditure and fund raising for E3 and F3. For E4, the project is judged feasible from both revenue and expenditure and fund raising conditions. But F4 will encounter difficulties.

1-4-2 FRR based on the C and D type Operating Expenses

As shown in Table 1-20 and 1-21, FRR is 28.39% in the case of C and 23.32% in the case of D indicating sufficient investment efficiency.

1-4-3 FRR of the Project Limited to the Construction of a Container Berth

This analyzes the investment efficiency by means of FRR for the project of construction of one container berth and land-related facilities and the purchase of cargo handling equipments. The fram work is set at the total services provided by the new and the existing facilities for handling general cargoes, containers and grains.

1) Reference materials used for this analysis
   - (1) Forecast of Cargo Volume at Callo Port ..... Table 1-22
   - (2) Forecast of Cargo Volume for Storage ..... Table 1-23(1) and Table 1-23(2)
   - (3) Number of ships ..... Table 1-24
   - (4) Total GRT and number of berthing days ..... Table 1-25
   - (5) Revenue and Expenditure ..... Table 1-26
   - (6) Project cost ..... Table 1-27

2) Project life

The project life is set to terminate in 2002 or 15 years after the completion of the facilities as is the case of economic analysis.

3) Calculation and evaluation on FRR

FRR is calculated from the above materials.

FRR is obtained for the operating expenses, B, C and D types which are 110%, 115% and 120% of the type A respectively. The resulting FRR is 100% or higher for the case of B type, 79.63% for the case of C type and 53.19% for the case of D type. It can be understood that in all of the cases the inplementation of the project will bring good profits. As the current container tariff is set higher prices with a low rate of operation, it should be reviewed when the handling of containers at 5B berth and the new container terminal achieves the full scale operation. Based upon the operating expenses of B type, the revenue decrease by 10%, 20% and 30% respectively. The analysis of three cases reveals that FRR are respectively 41.41%, 18.70% and 3.85%. The project should be judged feasible with the maximum decrease in revenue by 20%.

Table 1-17 Estimated Revenue and Expenditure (Summary)

(Unit: Million US$)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Revenue																										
Case-C3, C4, -D3, D4		63	67	64	63	68	70	86	97	106	106	107	108	108	109	110	111	111	111	111	111	111	111	111	111	111
Expenditure																										
Case-C3		62	64	62	62	64	69	84	83	83	81	81	80	78	78	77	77	75	74	74	74	74	74	73	73	73
-D4		62	64	61	60	61	64	78	78	78	77	77	77	76	76	76	76	76	75	75	75	74	74	73	73	73
-D3		65	66	64	64	67	72	87	86	86	84	84	83	82	81	80	80	79	77	77	77	77	77	76	76	76
-D4		65	66	64	63	64	66	81	81	82	81	80	80	79	79	79	79	79	78	78	78	78	77	77	77	76
Profit before Depreciation																										
Case-C3		1	3	2	1	4	1	2	14	23	25	26	28	30	31	33	34	36	37	37	37	37	37	38	38	38
-C4		1	3	3	3	7	6	8	19	28	29	30	31	32	33	34	35	35	36	36	36	37	37	37	37	38
-D3		-2	1	0	-1	1	-2	-1	11	20	22	23	25	26	28	30	31	32	34	34	34	34	34	35	35	35
-D4		-2	1	0	0	4	4	5	16	24	25	27	28	29	30	31	32	32	33	33	33	33	34	34	34	35
Less Depreciation		1	1	2	2	2	2	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	4	2	2
Profit after Depreciation																										
Case-C3		0	2	0	-1	2	-1	-5	7	16	18	19	21	23	24	26	27	29	30	30	30	30	30	34	36	36
-C4		0	2	1	1	5	4	1	12	21	22	23	24	25	26	27	28	28	29	29	29	30	30	33	35	36
-D3		-3	0	-2	-3	-1	-4	-8	4	13	15	16	18	19	21	23	24	25	27	27	27	27	27	31	33	33
-D4		-3	0	-2	-2	2	2	-2	9	17	18	20	21	22	23	24	25	25	26	26	26	26	27	30	32	33
Income Tax																										
Case-C3		0	1	0	0	1	0	0	3	8	9	9	10	11	12	13	13	14	15	15	15	15	15	17	18	18
-C4		0	1	0	0	2	2	0	6	10	11	11	12	12	13	13	14	14	14	14	14	15	15	16	17	18
-D3		0	0	0	0	0	0	0	2	6	7	8	9	9	10	11	12	12	13	13	13	13	13	15	16	16
-D4		0	0	0	0	1	1	0	4	8	9	10	10	11	11	12	12	12	13	13	13	13	13	15	16	16
Profit after Income Tax																										
Case-C3		0	1	0	-1	1	-1	-5	4	8	9	10	11	12	12	13	14	15	15	15	15	15	15	17	18	18
-C4		0	1	1	1	3	2	1	6	11	11	12	12	13	13	14	14	14	15	15	15	15	15	17	18	18
-D3		-3	0	-2	-3	-1	-4	-8	2	7	8	8	9	10	11	12	12	13	14	14	14	14	14	16	17	17
-D4		-3	0	-2	-2	1	1	-2	5	9	9	10	11	11	12	12	13	13	13	13	13	13	14	15	16	17
Accumulated Net Profit from 1981																										
Case-C3	25	25	26	26	25	26	25	20	24	32	41	51	62	74	86	99	113	128	143	158	173	188	203	220	238	256
-C4	25	25	26	27	28	31	33	34	40	51	62	74	86	99	112	126	140	154	169	184	199	214	229	246	264	282
-D3	25	22	22	20	17	16	12	4	6	13	21	29	38	48	59	71	83	96	110	124	138	152	166	182	199	216
-D4	25	22	22	20	18	19	20	18	23	32	41	51	62	73	85	97	110	123	136	149	162	175	189	204	220	237

Table 1-18 Estimated Source and Application of Funds (Summary)

(Unit: Million US$)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Source of Funds																										
Profit before Depreciation																										
Case-C3		1	3	2	1	4	1	2	14	23	25	26	28	30	31	33	34	36	37	37	37	37	37	38	38	38
-C4		1	3	3	3	7	6	8	19	28	29	30	31	32	33	34	35	35	36	36	36	37	37	37	38	38
-D3		-2	1	0	-1	1	-2	-1	11	20	22	23	25	26	28	30	31	32	34	34	34	34	34	35	35	35
-D4		-2	1	0	0	4	4	5	16	24	25	27	28	29	30	31	32	32	33	33	33	33	34	34	34	35
Long-term Loans																										
Case-C3, C4		5	7	9	23	14	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-D3, D4																										
Total																										
Case-C3		6	10	11	24	18	53	2	14	23	25	26	28	30	31	33	34	36	37	37	37	37	37	38	38	38
-C4		6	10	12	26	21	58	8	19	28	29	30	31	32	33	34	35	35	36	36	36	37	37	37	38	38
-D3		3	8	9	22	15	50	-1	11	20	22	23	25	26	28	30	31	32	34	34	34	34	34	35	35	35
-D4		3	8	9	23	18	56	5	16	24	25	27	28	29	30	31	32	32	33	33	33	33	34	34	34	35
Application of Funds																										
Cost of Fixed Assets Addition		5	7	9	23	14	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment of Long-term Loans																										
Case-C3		0	0	0	0	0	9	9	9	9	9	9	9	9	9	9	9	9	2	0	0	0	0	0	0	0
-C4		0	0	0	0	0	3	3	3	7	7	7	7	7	7	7	7	7	7	4	4	4	4	4	4	4
-D3		0	0	0	0	0	9	9	9	9	9	9	9	9	9	9	9	9	2	0	0	0	0	0	0	0
-D4		0	0	0	0	0	3	3	3	7	7	7	7	7	7	7	7	7	7	4	4	4	4	4	4	4
Income Tax																										
Case-C3		0	1	0	0	1	0	0	3	8	9	9	10	11	12	13	13	14	15	15	15	15	15	17	18	18
-C4		0	1	0	0	2	2	0	6	10	11	11	12	12	13	13	14	14	14	14	14	15	15	16	17	18
-D3		0	0	0	0	0	0	0	2	6	7	8	9	9	10	11	12	12	13	13	13	13	13	15	16	16
-D4		0	0	0	0	1	1	0	4	8	9	10	10	11	11	12	12	12	13	13	13	13	13	15	16	16
Total																										
Case-C3		5	8	9	23	15	61	9	12	17	18	18	19	20	21	22	22	23	17	15	15	15	15	17	18	18
-C4		5	8	9	23	16	57	3	9	17	18	18	19	19	20	20	21	21	21	18	18	19	19	20	21	22
-D3		5	7	9	23	14	61	9	11	15	16	17	18	19	19	20	21	21	15	13	13	13	13	15	16	16
-D4		5	7	9	23	15	56	3	7	15	16	17	17	18	18	19	19	19	20	17	17	17	17	19	20	20
Increase/Decrease (−) of Net Current Assets																										
Case-C3		1	2	2	1	3	-8	-7	2	6	7	8	9	10	10	11	12	13	20	22	22	22	22	21	20	20
-C4		1	2	3	3	5	1	5	10	11	11	12	12	13	13	14	14	14	15	18	18	18	18	17	16	16
-D3		-2	1	0	-1	1	-11	-10	-10	5	6	6	7	8	9	10	10	11	19	21	21	21	21	20	19	19
-D4		-2	1	0	0	3	0	2	9	9	9	10	11	11	12	12	13	13	13	16	16	16	17	15	14	15
Net Current Assets at End of Year																										
Case-C3	12	13	15	17	18	21	13	6	8	14	21	29	38	48	58	69	81	94	114	136	158	180	202	223	243	263
-C4	12	13	15	18	21	26	27	32	42	53	64	76	88	101	114	128	142	156	171	189	207	225	243	260	276	292
-D3	12	10	11	11	10	11	0	-10	-10	-5	1	7	14	22	31	41	51	62	81	102	123	144	165	185	204	223
-D4	12	10	11	11	11	14	14	16	25	34	43	53	64	75	87	99	112	125	138	154	170	186	203	218	232	247

Table 1-19 Estimated Balance Sheet (Summary)

(Unit: Million US$)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Assets																										
Fixed Assets	38	42	48	55	76	88	138	131	124	117	110	103	96	89	82	75	68	61	54	47	40	33	26	22	20	18
Net Current Assets																										
Case-C3	12	13	15	17	18	21	13	6	8	14	21	29	38	48	58	69	81	94	114	136	158	180	202	223	243	263
-C4	12	13	15	18	21	26	27	32	42	53	64	76	88	101	114	128	142	156	171	189	207	225	243	206	276	292
-D3	12	10	11	11	10	11	0	-10	-10	-5	1	7	14	22	31	41	51	62	81	102	123	144	165	185	204	223
-D4	12	10	11	11	11	14	14	16	25	34	43	53	64	75	87	99	112	125	138	154	170	186	203	218	232	247
Total																										
Case-C3	50	55	63	72	94	109	151	137	132	131	131	132	134	137	140	144	149	155	168	183	198	213	228	245	263	281
-C4	50	55	63	73	97	114	165	163	166	170	174	179	184	190	196	203	210	217	225	236	247	258	269	282	296	310
-D3	50	52	59	66	86	99	138	121	114	112	111	110	110	111	113	116	119	123	135	149	163	177	191	207	224	241
-D4	50	52	59	66	87	102	152	147	149	151	153	156	160	164	169	174	180	186	192	201	210	219	229	240	252	265
Capital Employed																										
Capital	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Long-term Loans																										
Case-C3	0	5	12	21	44	58	101	92	83	74	65	56	47	38	29	20	11	2	0	0	0	0	0	0	0	0
-C4	0	5	12	21	44	58	107	104	101	94	87	80	73	66	59	52	45	38	31	27	23	19	15	11	7	3
-D3	0	5	12	21	44	58	101	92	83	74	65	56	47	38	29	20	11	2	0	0	0	0	0	0	0	0
-D4	0	5	12	21	44	58	107	104	101	94	87	80	73	66	59	52	45	38	31	27	23	19	15	11	7	3
Other Reserves and Provision																										
Case-C3	25	25	26	26	25	26	25	20	24	32	41	51	62	74	86	99	113	128	143	158	173	188	243	220	238	256
-C4	25	25	26	27	28	31	33	34	40	51	62	74	86	99	112	126	140	154	169	184	199	214	229	246	264	282
-D3	25	22	22	20	17	16	12	4	6	13	21	29	38	48	59	71	83	96	110	124	138	152	166	182	199	216
-D4	25	22	22	20	18	19	20	18	23	32	41	51	62	73	85	97	110	123	136	149	162	175	189	204	220	237
Total																										
Case-C3	50	55	63	72	94	109	151	137	132	131	131	132	134	137	140	144	149	155	168	183	198	213	228	245	263	281
-C4	50	55	63	73	97	114	165	163	166	170	174	179	184	190	196	203	210	217	225	236	247	258	269	282	296	310
-D3	50	52	59	66	86	99	138	121	114	112	111	110	110	111	113	116	119	123	135	149	163	177	191	207	224	241
-D4	50	52	59	66	87	102	152	147	149	151	153	156	160	164	169	174	180	186	192	201	210	219	229	240	252	265

Table 1-20 F.R.R. (Case-C)

(Unit: 1,000 US$)

No	Year	Cost	Net Surplus Revenue			Balance		
		Project Cost	Revenue	Expenditure	Net Surplus	Rev.-Cost	F.R.R. 28.39 (%)	F.R.R. 20.00 (%)
0	1983	12,290	63,070	57,774	5,296	-6,994	-6,994	-6,994
1	1984	8,838	59,654	55,023	4,631	-4,207	-3,277	-3,506
2	1985	23,135	58,488	53,075	5,413	-17,722	-10,751	-12,307
3	1986	14,276	63,838	53,698	10,140	-4,136	-1,955	-2,394
4	1987	52,095	65,193	53,692	11,501	-40,594	-14,938	-19,577
5	1988	0	81,041	65,161	15,880	15,880	4,551	6,381
6	1989	0	92,174	65,771	26,403	26,403	5,893	8,842
7	1990	0	100,466	66,220	34,246	34,246	5,953	9,557
8	1991	0	100,920	66,220	34,700	34,700	4,698	8,070
9	1992	0	101,380	66,299	35,081	35,081	3,699	6,798
10	1993	0	101,802	66,338	35,464	35,464	2,913	5,727
11	1994	0	102,260	66,377	35,883	35,883	2,295	4,829
12	1995	0	102,684	66,415	36,269	36,269	1,807	4,067
13	1996	0	103,137	66,455	36,682	36,682	1,423	3,428
14	1997	0	103,386	66,477	36,909	36,909	1,115	2,879
15	1998	0	103,386	66,477	36,909	36,909	868	2,395
16	1999	0	103,386	66,477	36,909	36,909	676	1,996
17	2000	0	103,386	66,477	36,909	36,909	527	1,663
18	2001	0	103,386	66,477	36,909	36,909	410	1,386
19	2002	0	103,386	66,477	36,909	36,909	319	1,155
20	2003	0	103,386	66,477	36,909	36,909	249	962
21	2004	0	103,386	66,477	36,909	36,909	193	802
22	2005	0	103,386	63,587	39,799	39,799	162	720
23	2006	0	103,386	66,477	36,909	36,909	117	557
Residual Value			14,950		14,950	14,950	47	225
Total		110,634	2,229,967	1,530,398	714,519	603,885	0	27,656

Table 1-21 F.R.R. (Case-D)

(Unit: 1,000 US$)

No	Year	Cost	Net Surplus Revenue			Balance		
		Project Cost	Revenue	Expenditure	Net Surplus	Rev.-Cost	F.R.R. 23.32 (%)	F.R.R. 20.00 (%)
0	1983	12,290	63,070	60,286	2,784	-9,506	-9,506	-9,506
1	1984	8,838	59,654	57,415	2,239	-6,599	-5,352	-5,500
2	1985	23,135	58,488	55,382	3,106	-20,029	-13,172	-13,910
3	1986	14,276	63,838	56,033	7,805	-6,471	-3,451	-3,745
4	1987	52,095	65,193	56,027	9,166	-42,929	-18,565	-20,703
5	1988	0	81,041	67,994	13,047	13,047	4,575	5,243
6	1989	0	92,174	68,630	23,544	23,544	6,695	7,884
7	1990	0	100,466	69,100	31,366	31,366	7,233	8,753
8	1991	0	100,920	69,140	31,780	31,780	5,942	7,391
9	1992	0	101,380	69,181	32,199	32,199	4,882	6,240
10	1993	0	101,802	69,222	32,580	32,580	4,006	5,261
11	1994	0	102,260	69,263	32,997	32,997	3,290	4,440
12	1995	0	102,684	69,302	33,382	33,382	2,699	3,744
13	1996	0	103,137	69,344	33,793	33,793	2,216	3,158
14	1997	0	103,386	69,367	34,019	34,019	1,809	2,649
15	1998	0	103,386	69,367	34,019	34,019	1,467	2,208
16	1999	0	103,386	69,367	34,019	34,019	1,189	1,840
17	2000	0	103,386	69,367	34,019	34,019	964	1,533
18	2001	0	103,386	69,367	34,019	34,019	782	1,277
19	2002	0	103,386	69,367	34,109	34,019	634	1,064
20	2003	0	103,386	69,367	34,019	34,019	514	887
21	2004	0	103,386	69,367	34,019	34,019	417	739
22	2005	0	103,386	69,367	34,019	34,019	338	616
23	2006	0	103,386	69,367	34,019	34,109	274	513
Residual Value			14,950		14,950	14,950	120	225
Total		110,634	2,229,967	1,599,989	644,928	534,294	0	12,301

Table 1-22 Cargo Forecast for Callao Port Terminal

(Unit: 1,000t)

Year	Container									General Cargo			Grain
	Berth No.5B			New Container Berth			Total						
	Imp.	Exp.	Sub-total	Imp.	Exp.	Sub-total	Imp.	Exp.	Total	Imp.	Exp.	Total	Imp.
1983	148	110	258	0	0	0	148	110	258	1,496	734	2,230	1,190
1984	207	160	367	0	0	0	207	160	367	1,455	695	2,150	1,224
1985	273	233	506	0	0	0	273	233	506	1,480	670	↓	↓
1986	349	301	650	0	0	0	349	301	650	1,504	646		
1987	379	271	650	0	0	0	379	271	650	1,479	671		
1988	256	217	473	335	283	618	591	500	1,091	1,551	599		
1989	317	258	575	416	337	753	733	595	1,328	1,569	581		
1990	369	281	650	482	368	850	851	649	1,500	1,572	578		
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
2002	369	281	650	482	368	850	851	649	1,500	1,572	578	2,150	1,224

Table 1-23 (1) Stored Cargo Volume of General Cargo

(Unit: 1,000t)

Year	General Cargo Volume			Stored Cargo Volume		
	Imp.	Exp.	Total	Imp. (79%)	Exp. (61%)	Total
1983	1,496	734	2,230	1,182	448	1,630
1984	1,455	695	2,150	1,149	424	1,573
1985	1,480	670	↓	1,169	409	1,578
1986	1,504	646	↓	1,188	394	1,582
1987	1,479	671	↓	1,168	409	1,577
1988	1,551	599	↓	1,225	365	1,590
1989	1,569	581	↓	1,240	354	1,594
1990	1,572	578	↓	1,242	353	1,595
↓	↓	↓	↓	↓	↓	↓
2002	1,572	578	2,150	1,242	353	1,595

Table 1-23 (2) Stored Cargo Volume of LCL Container Cargo at Berth No. 5B

(Unit: 1,000t)

Year	LCL Container Cargo Volume
1983	129
1984	183.5
1985	253
1986	325
1987	325
1988	236.5
1989	287.5
1990	325
↓	↓
2002	325

Table 1-24 Numbers of Ships

	General Cargo Ships	Container Ships	Grain Ships	Total
1983	1,110	80	55	1,245
1984	1,070	113	57	1,240
1985	↓	156	↓	1,283
1986	↓	201	↓	1,328
1987	↓	201	↓	1,328
1988	↓	337	↓	1,464
1989	↓	410	↓	1,537
1990	↓	463	↓	1,590
↓	↓	↓	↓	↓
2002	1,070	463	57	1,590

Table 1-25 Total GRT and Total GRT·DAYS of Ships

Year	General Cargo Ships		Container Ships		Grain Ships		Total	
	Total GRT	Berthing Days × Total GRT	Total GRT	Berthing Days × Total GRT	Total GRT	Berthing Days × Total GRT	Total GRT	Berthing Days × Total GRT
1983	8,040,840	29,751,108	2,400,000	3,600,000	1,025,915	4,616,618	11,466,755	37,967,726
1984	7,751,080	28,678,996	3,390,000	5,085,000	1,063,221	4,784,495	12,204,301	38,548,491
1985	↓	↓	4,680,000	7,020,000	↓	↓	13,494,301	40,483,491
1986	↓	↓	6,030,000	6,210,000	↓	↓	14,844,301	39,674,391
1987	↓	↓	6,030,000	6,210,900	↓	↓	14,844,301	39,674,391
1988	↓	↓	10,110,000	7,683,600	↓	↓	18,924,301	41,147,091
1989	↓	↓	12,300,000	9,348,000	↓	↓	21,114,301	42,811,491
1990	↓	↓	13,890,000	10,556,400	↓	↓	22,704,301	44,019,891
↓	↓	↓	↓	↓	↓	↓	↓	↓
2002	7,751,080	28,678,976	13,890,000	10,556,400	1,063,221	4,784,495	22,704,301	44,019,891

Table 1-26 Revenue and Expenditure

(Unit: US$1,000)

Year	Revenue					Expenditure										
	Shipping Services	Cargo handling Services	Cargo storage Services	Others	Total	Personnel Costs	Material Costs	Outside Job Costs	Sub-total (A type)	Others (sub-total x %)			Total			
										10% (B type)	15% (C type)	20% (D type)	A type	B type	C type	D type
1983	12,967	37,905	10,961	1,237	63,070	42,016	2,378	5,844	50,238	5,024	7,536	10,048	50,238	55,262	57,774	60,286
1984	13,587	40,397	10,646	1,293	65,923	41,843	2,380	5,845	50,068	5,007	7,510	10,014	50,068	55,075	57,578	60,082
1985	14,778	44,128	10,815	1,394	71,115	42,340	2,401	5,857	50,598	5,060	7,590	10,120	50,598	55,658	58,188	60,718
1986	15,699	48,372	10,976	1,501	76,548	42,853	2,423	5,870	51,146	5,115	7,672	10,229	51,146	56,261	58,818	61,375
1987	15,699	49,790	10,806	1,526	77,821	42,843	2,423	5,870	51,136	5,114	7,670	10,227	51,136	56,250	58,806	61,363
1988	18,931	61,729	11,288	1,828	93,236	49,105	2,743	8,393	60,291	6,029	9,044	12,058	60,291	66,320	69,335	72,349
1989	20,767	69,481	11,415	2,033	103,696	49,567	2,816	8,404	60,787	6,079	9,118	12,157	60,787	66,866	69,905	72,944
1990	22,100	75,823	11,432	2,187	111,542	49,865	2,869	8,412	61,146	6,115	9,172	12,229	61,146	67,261	70,318	73,375
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
2002	22,100	75,823	11,432	2,187	111,542	49,865	2,869	8,412	61,146	6,115	9,172	12,229	61,146	67,261	70,318	73,375

Table 1-27 Project Cost

(Unit: US$1,000)

Year	Project cost
1983	*11,102
1984	2,457
1985	17,603
1986	10,144
1987	30,616
Total	60,952

*The cost includes 5,000 for 1982 and 6,000 for 1983, total 11,000 (Unit· US$1,000) as the estimated consturction costs for a container yard for container cargoes at Berth No. 5B.

2. CONTAINER TERMINAL FACILITIES AND EQUIPMENT PLAN

2-1 Terminal facilities

About the objects and scale of the main facilities.

(1) Mooring equipments

It is always necessary to keep full container ships close to the pier apron, because they have a larger wind receiving surface, and bigger gross tonnages, compared with ordinary general cargo vessels.

As the mooring equipment on board full container ships is installed on the forecastle and at the stern, arrangement of mooring bitts on the apron should be made, as much as possible, near the ship's fore and after parts. Also fuel and water supply pipes, telephone connecting lines, and wharf line lighting equipment are necessary.

(2) Apron

The space between the pier end and the container yard, 34 meters, is called the apron. Within the 2 meters between the pier end and the container crane's seaside rail, the gutter for the container cranes electric power cable and the vehicle stopper are installed. There are 16 meters between the seaside rail and the landside rail of the container crane, which will be used for trailer traffic, temporary placing of dis/load containers, and exchanging operations of container crane spreaders. (when repairs are needed)

There are 16 meters between the landside rail of the container crane and the container yard and where the ship's hatch covers are temporally placed. Anchor equipment for the container cranes are installed on middle section of the berth where the two cranes can be positioned close together.

(3) Container yard

The container yard is a place which maintains free spaces for container ship's loading and discharging operations, stores full and empty containers, and delivers containers to CFS or consignees.

The container yard has been paved all over with asphalt and especially placed PC concrete plate at the points supporting four container corner post castings.

The passage way for the rubber tired transfer crane will be paved heavily with cement concrete, and passage for trailers will be paved with asphalt concrete. Whole surface of container yard will have a slope of 1 meter in 100 meters, for the sake of water drainage.

Refriger engine power plug units will be installed at spaces for refrigerated container storage.

Enough illumination equipment shall be installed to obtain over 20 lux/m^2 at any place in the container yard for night container operation. The container yard shall be surrounded by metal nets greater than 2 m in height for the sake of the safety of operations and of the customs bonded area.

The container yard is laid out in rectangular blocks, the long sides parallel to the pierline, and a 20 m spacing between block ends, where trailer movement and the shifting of transfer cranes

from one block to the next takes place. The spacing between the sides of the blocks is tight, leaving room every two blocks for trailer passages, one for each adjoining block.

Within the blocks the containers are placed end to end, in six rows, leaving a 30 cm clearance between the rows and 40 cm between container ends. In the case of refrigerated containers the end to end spacing is 150 cm.

(4) Maintenance facilities

Inspection of containers, cleaning of containers before or after used, repairing of damaged containers, and container and cargo handling machine maintenance will be done here.

a) Maintenance shop

The maintenance shop is in part a 2 story building, the 1st floor space is 20 m x 30 m = 600 m^2 and it is paved with cement concrete all over. It is used as the repair shop for cargo handling machines and heavy damaged containers, and also used as the spare parts stock place.

The maintenance shop has the cargo handling machine's repair pit, a 5 ton trolly crane on a cell beam, a compresser (14 kgs/cm^2), hydraulic jacks (50 tons, 30 tons, 10 tons), a dynamo generator (5 KVA), and a welding machine, hot air dryer, bowling machine, lathe, glinder, etc. as auxiliary equipment.

2nd floor (200 m^2) will be the office of the maintenance team.

b) Container water cleaning space

Floor space is 1,800 m^2 and is paved with cement concrete.

It is equipped with a high pressured hot water cleaner, an oil/water separator, and contaminated water treatment equipment, and has a slope of 1 meter in 50 meters, for the sake of water drainage.

c) Container repairing and inspection space

It takes 2,880 m^2 floor space and is paved with asphalt. Ten electric power plugs and cradles for container repairing will be arranged.

d) Fuel supply equipment

Floor space is 300 m^2 and it has an oil anti-leaking gutter around the space. It has an oil supplying pump on the ground, and a fuel storage tank under the ground.

e) Electric power transformer equipment

Receiving high voltage electric power from outside the transformer steps it down to suitable voltage for each machine and facility.

On the 2nd floor, is installed the electric distribution panel, and the control panel. In the refrigerated container yard, transformers which adjust to every necessary container voltage, will be distributed in every refrigerated container storage block.

Electric power supply to each facility and machine in the container terminal shall be buried under the ground, to avoid interferring with vehicles, and cargo handling machinery operation.

f) Water supply equipment

Water tank facilities and distribution pipe will be installed for water supply to the container vessels, water cleaning of containers and cargo handling machines, the fire station, and for providing living water supply to the offices.

The water pipe design should be circular systems to keep fresh water always running. It will be underground piping for the sake of vehicles and cargo handling machinery working area.

(5) Gate house

Inspection for damage of containers coming in/out to/from the container yard, weighing, necessary paper delivery, and instruction to the trailer drivers are performed at this point.

The gate house has 6 lanes for trailer passages, and 3 booths, 4 weighing scales (50 tons) and a checking stage for container top inspection, included in this short term development plan.

(6) Administration facilities

(a) Administration building (office building)

This office houses the administration division which plans and supervises the overall operation of the container terminal.

A 3 story building which has 1,500 m^2 floor space will be constructed in this short term plan.

3rd floor : offices of the planning and yard control sections, telex, computer machinery room, machinery power plant room for this building.

2nd floor : offices fo shipping companies, agents, custom officer, animal quarantine officer, and plant quarantine officer.

1st floor : General affair department, documentation section of the operation department. Rest room for terminal workers.

(b) CFS office

Connecting to the CFS cargo space, there will be arranged 800 m^2 of offices, for planning and supervising of the necessary operations for break bulk cargo receiving/delivering and container moving from/to container yard, and related documentation work.

Also this space includes canteen and resting room for the officers and workers, in the CFS.

(7) Parking space

In this short term plan (B), the following parking spaces are arranged.

Shipper/consignee trailer parking space	2,875 m^2
Terminal trailer parking space	2,100 m^2
Personally owned car parking space	1,200 m^2
Total	6,175 m^2

(8) Container Freight Station (CFS)

Delivery/receiving of LCL cargoes, stuffing/unstuffing of container cargoes, Customs clearance, and other government inspection are done in this station. Floor surface height of CFS will be about 1.3 meters the same as the height of trucks or of container floors when loaded on a chassis. It has ramp ways to provide easy access for forklift trucks. For determining the number of necessary CFS spaces, CFS cargo staying days and percentage of CFS cargo to total container cargo are very important factors. The experience of general container terminals in Japan is that

CFS cargo staying days come to 7 days and that CFS cargo percentage is about 15% of all container cargo. But according to the Japanese mission's investigation at Callao port, last year, they are 14 days and CFS cargoes are 40 – 60% of all container cargo. In the future, if handling number of containers would increases, CFS cargo percentage will decrease at Callao port.

In this short term plan CFS necessary spaces are caliculated by staying days (7 days) and percentage of CFS cargoes (50%). By the next construction period, ENAPU will have a better idea of the necessary CFS space and scale, according to CFS cargo percentage at that time. As a result of calculation, on the short term plan, CFS space will be 10,500 m^2. Following is the CFS arrangement of short term plan. (Fig. 2-1)

The length of the CFS shed is 175 m, width is 60 m, and it is possible to line up 36 chassis along one side of CFS shed and to do stuffing/unstuffing at the same time. A 4 meter wide space was designed on both sides of the CFS for working space for trucks and chassis, and a 4 meter wide passage will be left in the middle of the CFS space. It is used as forklift operation space for moving of palletized cargo, storage, taking things in and out.

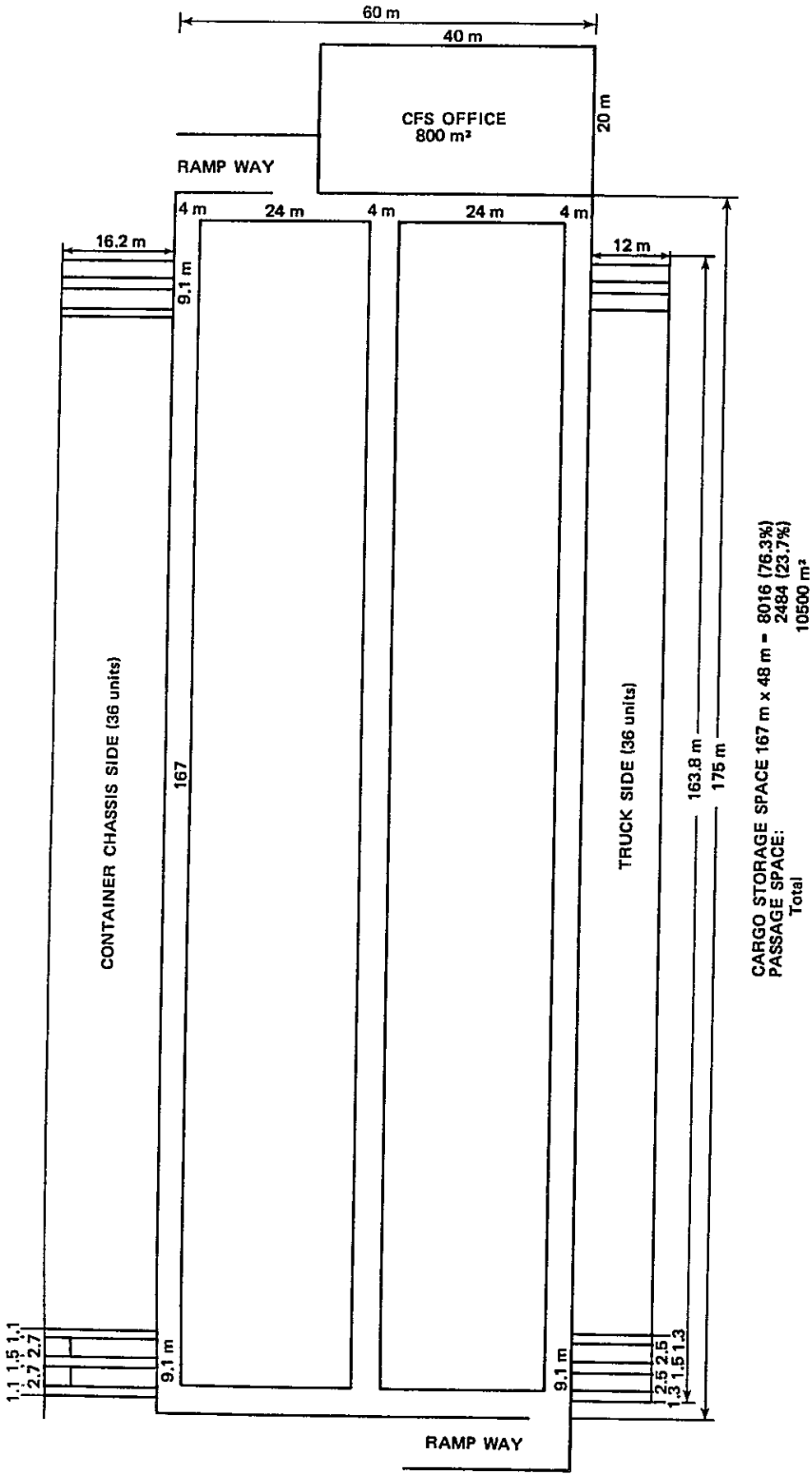


Fig. 2-1 CONTAINER FREIGHT STATION ARRANGEMENT (Short Term Plan)

2-2 Cargo Handling Equipment

The necessary number of container cargo handling equipment is shown on the lists (Table 2-1) for master plan, and short term plan.

Following are explanations of the main particulars of each container cargo handling machine.

Table 2-1 Container Cargo Handling Equipment

Description of Equipment	Quantity	
	Master Plan	Short Term Plan
(Ship's operation)		
Container cranes	8	2
Tractors	48	12
Chassis 40' (20' x 2)	48	12
(Yard operation)		
Rubber tired transfer cranes	24	6
(CFS operation)		
Forklift trucks 2.5 tons	60	15
6 "	8	2
Tractors	20	5
Chassis 20'	104	26
40'	40	10
Pallet board (1.8 m x 1.2 m)	12,000	3,000
(Gate operation)		
Weighing scales	16	4
(Maintenance operation)		
Forklift trucks (Tope lifter)		1
15 tons	4	1
10 "	4	1
Repairing shop truck	12 ea	3 ea
(Terminal office)		
Wireless telephone (VHF)	120	30
Computer	2 set	1 set

(1) Container crane

A container crane moves on the rails which are installed alongside the pier apron. The trolley cabin moves across the ship, along the crane boom over the container ship, which is alongside the pier.

The spreader which is hanging from the trolley will lock up containers and lift containers up and down. Then, container loading/unloading has been done.

Loaded weight	continuous working of containers (without spreader)	30.5 k/tons
Lifting weight	including spreader	50 k/tons

Rail span		16 meters
Out reach	ex sea side rail	36 meters
Back reach	ex land side rail	11 meters
Width between rails		16 meters
Lifting distance	over sea side rail surface	25 meters
Lifting distance	under sea side rail surface	14 meters
Crane weight		550 k tons
Lifting speed	full load	45 m/min.
Lifting speed	no load	90 m/min.
Trolley speed		150 m/min.
Gantry speed		45 m/min.
Crane boom setting speed		10 min./cycle
Spreader (20'/40' extender)		3 units/2 crane
Spreader dolly		1 unit
40 ton heavy lifting beam		1 unit
Over height spreader		1 set

(2) Transfer crane with rubber tires

A rubber tired transfercrane moves to the designated yard slot, on it's PC concrete paved plates which run along each side of the container blocks. Between block ends perpendicular crossing plate ways are also laid out.

The trolley runs alongside the upper beam, a bridge-type girder, which is supported by two running legs.

The spreader, which hanges, from the trolley, grasps containers and lifts them up or down. Transferring operation is been done between trailer and designated slot of the container yard.

Working load capacity		30.5 tons
Running legs span	(6 containers lines and 1 trailer passage)	23.47 meters
Spreader lifting distance	(9½' container 4 tiers)	12.22 meters
Crane weight		110 tons
Number of wheels		8 wheels
Lifting speed	no load	18 meters/min.
Lifting speed	full load	9 〃 〃
Trolley speed		35 〃 〃
Gantry speed		90 meters/min.
Steering system		90 turn
Spreader (20'/40' extension)		7 units/6 cranes
Spreader dolly		1 unit/6 cranes
Over height spreader		2 sets/berth
Engine power	diesel engine (4 cycle, water cooling)	260 PS/1,800 RPM

(3) Tractor and chassis

Chassis' which are exclusively used for container transportation are hauled by tractor. They are used for moving containers between the container shipside and the container yard or CFS.

(a) Tractor

No. 5 wheel loaded weight		9 tons
Length over all		5.6 meters
Width		2.5 "
Tractor weight		6 tons
Engine power	diesel engine	350 PS/2,500 RPM

(b) Chassis

Maximum load	40' container x 1	30.5 tons
	20' container x 2	40.6 tons
Length over all		12.8 meters
Length of tractor with chassis		16.4 meters
Chassis weight		6.5 tons
Width		2.65 meters
Container fixing system		socket system

(4) Weight scale

There are 2 weight scales installed at the FCL export container entrance lanes of the gatehouse, and 2 more at the FCL import container exit lanes. In total 4 weight scales will be installed.

Total weight of containers and passing trailers is indicated on the repeater panel in the booth, and at the same time weighing date and weights are printed out on the slip.

Maximum weight capacity	50 tons
Size of platform	18 m x 3.5 m

(5) 2.5 ton fork lift

It is used for packing and unpacking cargoes in to/from containers, cargo moving between break bulk cargo storage space and the containers, and receiving/delivery to the shipper/consignee trucks.

It is necessary to satisfy the following conditions, when deciding forklift model and type for the CFS operation.

(a) Smallest possible turning radius is required for operations inside the CFS shed.

(b) Limitted mast height less than the inside door clearance (2.14 m) is required, so that a full free lift type mast is suitable.

(c) Due to the limitation of the container floor surface strength, the lightest possible, light weight model is desirable.

(d) Considering that the trend is for unit cargo containers to increase in weight, the forklift should be powerful enough to cope with the future cargoes.

Maximum load capacity			2.5 tons
Highest lifting range			3.3 meters
Free lift lifting range			1.22 meters
Operation speed	forward	(300 m/min.)	18 km/hr
	backward	(300 m/min.)	18 km/hr
Length over all (including fork part)			3.6 meters

Forklift weight			3.84 tons
Power	diesel engine		50 PS/2,400 RPM

(6) **6 tons fork lift**

Handling heavy and bulky cargo at CFS operation

Maximum load			6 tons
Highest lifting range			3 meters
Operation speed	forward	(450 m/min.)	27 km/hr
	backward	(450 m/min.)	27 km/hr
Length over all (including fork part)			4.8 meters
Forklift weight			8.22 tons
Power	diesel engine		80 PS/2,400 RPM

(7) **10 tons forklift**

Handling heavy and bulky cargo at CFS and around CFS.

Maximum load			10 tons
Highest lifting range			3 meters
Operation speed	1st	(183 m/min.)	11 km/hr
	2nd	(400 m/min.)	24 km/hr
Length over all (including fork part)			5.5 meters
Forklift weight			13.9 tons
Power	diesel engine		113 PS/2,000 RPM

(8) **15 ton forklift (with 20'/40' extention system side spreader)**

Mainly handling of 20'/40' empty containers at the empty container depot, and container repairing yard.

By catching 2 corner top castings of the container fore and aft, with the side spreader installed on the forklift mast and at the same time holding the container's side plate with the forklift's foreward face, the forklift lifts and moves containers.

Maximum load	40' reefer container	6 tons
Highest lifting range	9'½ high container 3 tiers	8.7 meters
Operation speed	(400 m/min.)	24 km/hr
Length over all (including container)		8.4 meter
(only with side spreader)		6 meters
Forklift weight		25 tons
Power	diesel engine	130 PS/2,000 RPM

(9) **Pallet board**

It is used in the CFS for the sake of high stacking which can increase stacking capacity, and for rapid movement of break bulk cargo by forklift.

Size of pallet board 1.8 m x 1.2 m

(10) Wireless telephone (VHF)

It is used for transmitting the instructions for the container yard moving plan, and the ship's cargo operation plan, from the yard operation control center in administrative building to each cargo handling machine driver and to the ship supervisor on board the container ship.

Frequency	150 MHZ zone
Number of channels	6 channel
Out put power	5 W
Electric supply voltage from each cargo handling machinery	DC 24 V, AC 100 V, AC 220 V

(11) Computer

It is planned that for the short term plan, 124,650 TEU containers would be handled annually.

A yard plan computer system is necessary, to deal with the container yard flow control and to do inventory quickly and accurately.

Computer costs are excluded as the computer is used by ENAPU on a rental system.

Main business

(a) Container inventory which is stowed in the container terminal.

(b) Finding container yard storage slots, and deciding slot allocation for incoming and outgoing containers.

(c) Printing out container ship working sequence check list.

(d) Printing out container exit gate working schedule list.

(e) Printing out necessary statistics tables.

For guidance, the following is an example of computer capacity.

C.P.U.	1 unit
Core memory	16 bits 256 kilobite
Cycle time	500 nano second
Magnetic tape instrument	1 unit
tape speed	45 inches/sec
memory capacity	800 – 1,600 bite/inches
Magnetic disc instrument	1 unit
memory capacity	67 mega bite
Averaged accesstime	38 mili meters/sec
High speed printing machine	1 unit
One line printing letters	132 letters
printing speed	300 lines/min.
CRT display	8 units
display letters	1,920 letters (80 letters x 24 lines)
display speed	300 – 2,400 bit/sec
Low speed printing machine	2 units
one line printing letters	132 letters
printing speed	180 letters/sec

SPECIFICATION	
HOISTING LOAD	HOISTING LOAD 15t RATED LOAD 30.5 t
HOISTING SPEED	36/72 m/min
TROLLEY TRAVEL SPEED	125 m/min
GANTRY TRAVEL SPEED	45 m/min
BOOM HOIST SPEED	5 min/oneway

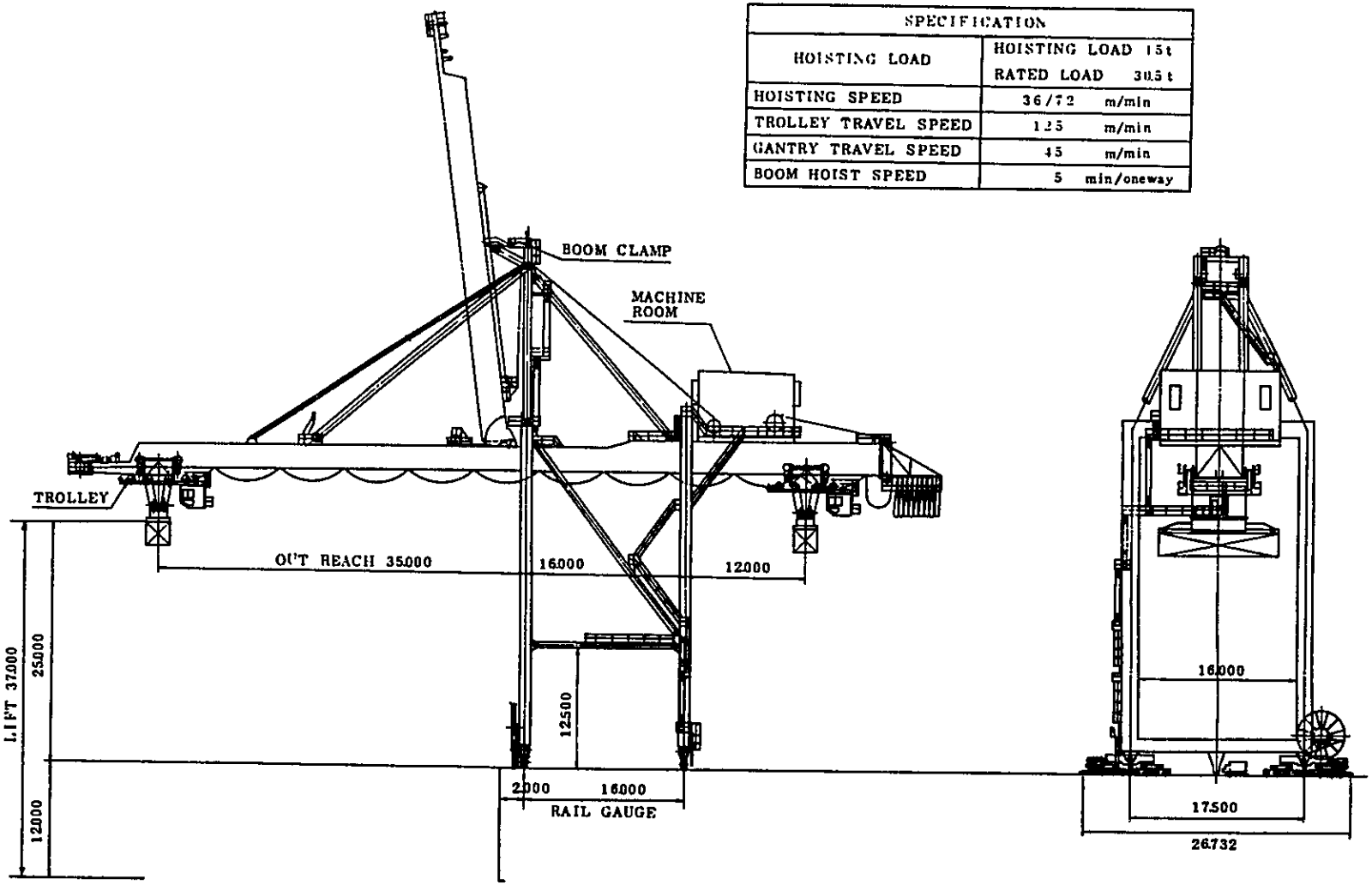


Fig. 3-1 Container Crane

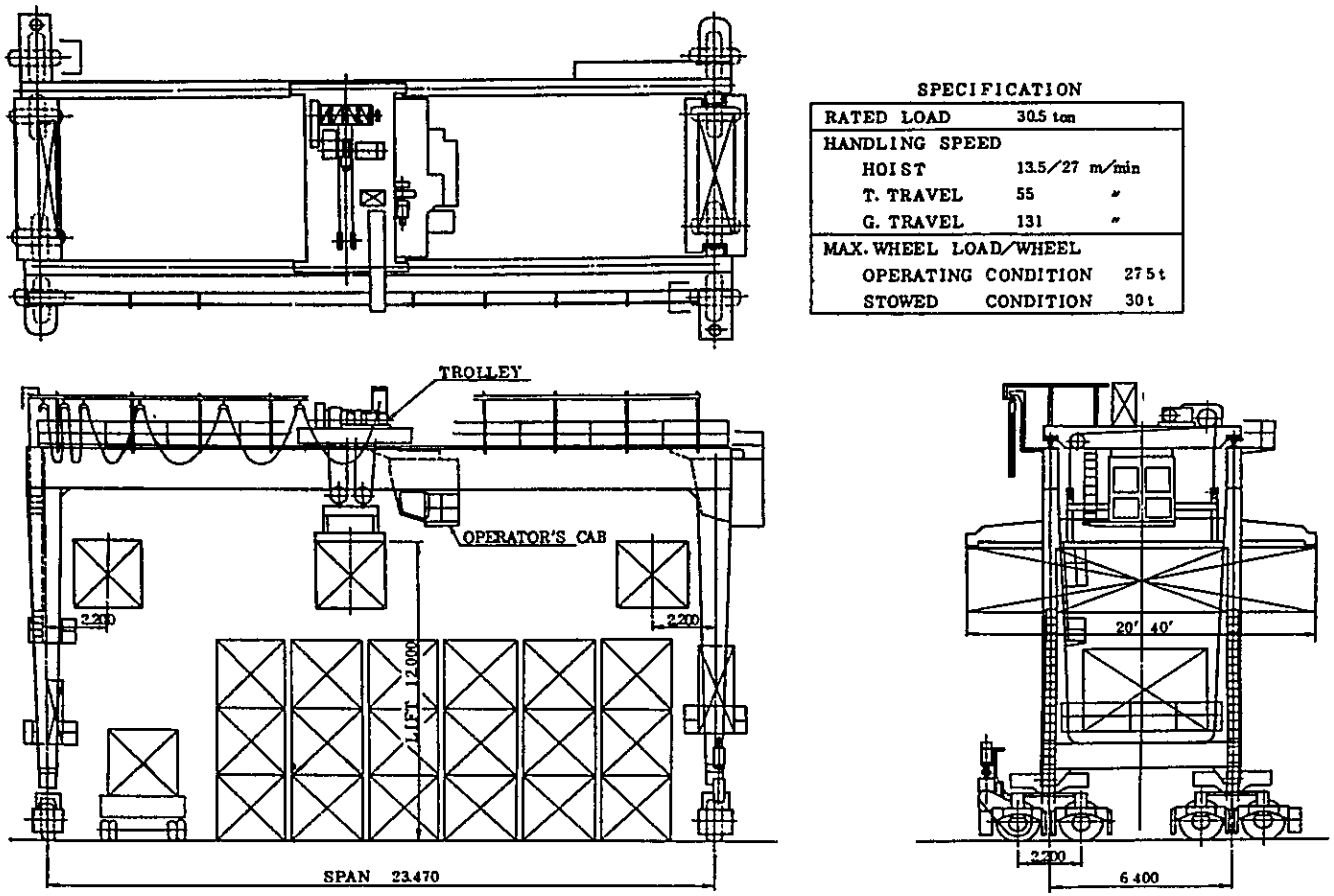
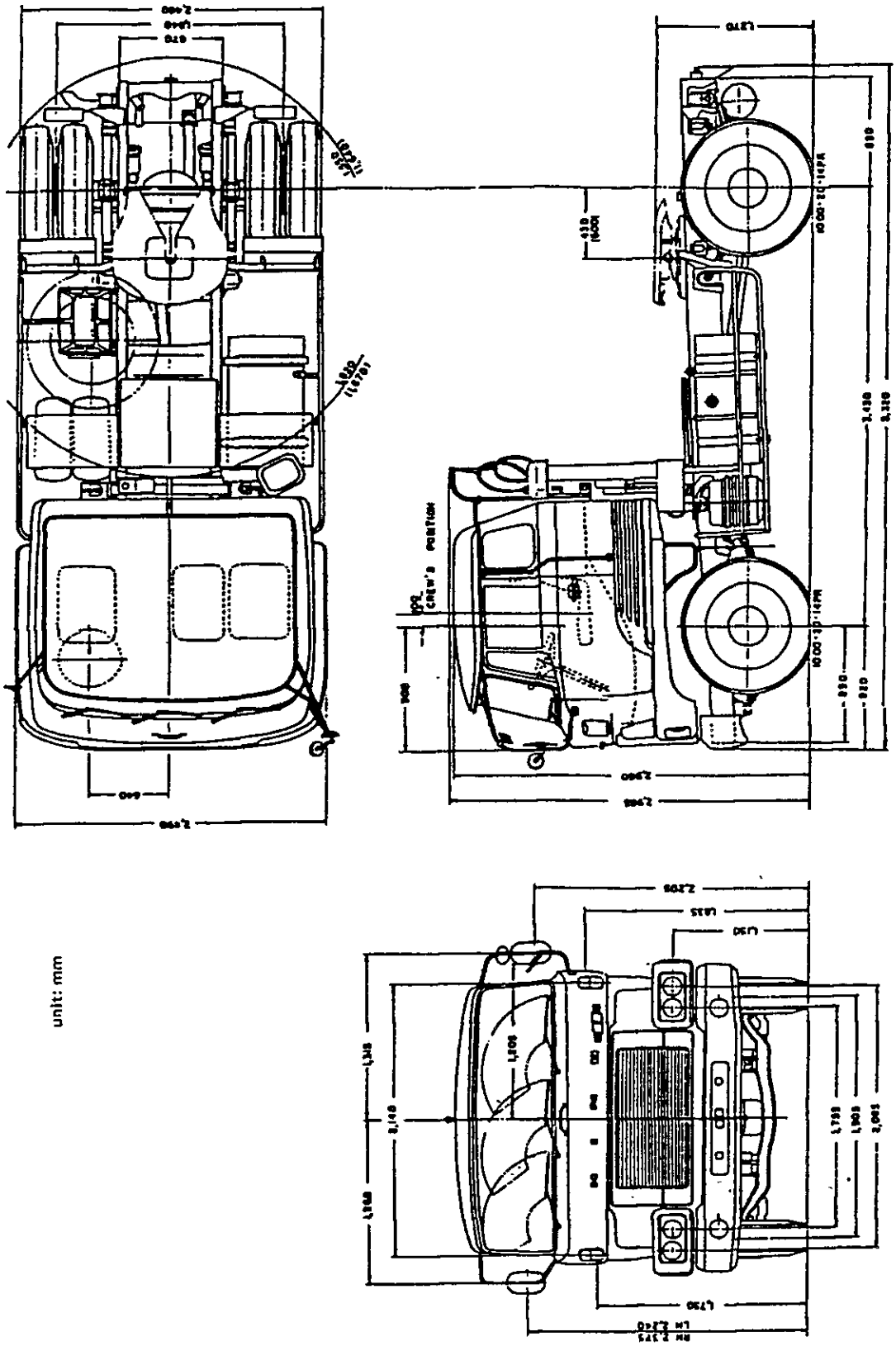


Fig. 3-2 Tire-Mounted Transfer Crane



unit: mm

Fig. 3-3 Trailer Head

unit: mm

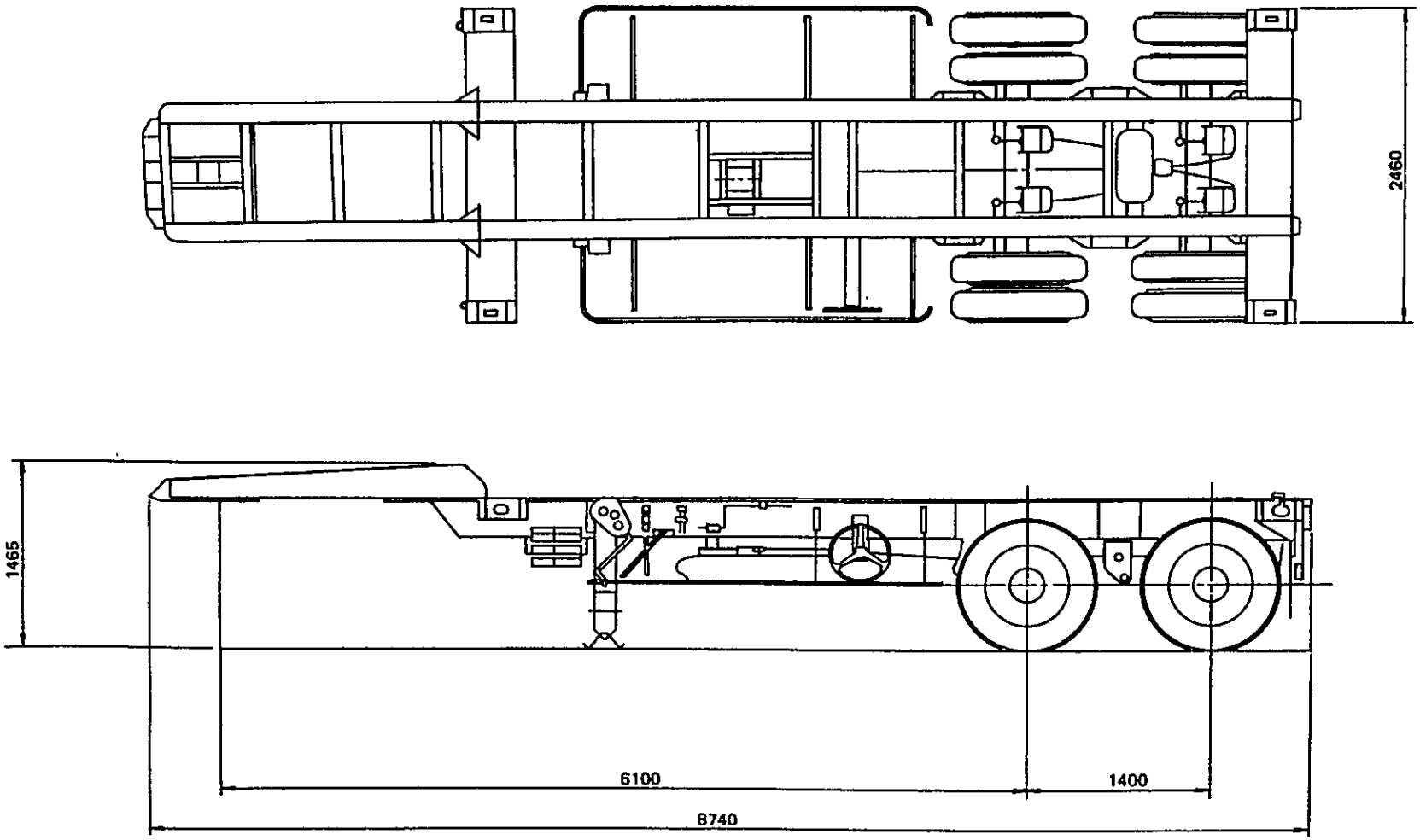


Fig. 3-4 Chassis for 20' Sea Container

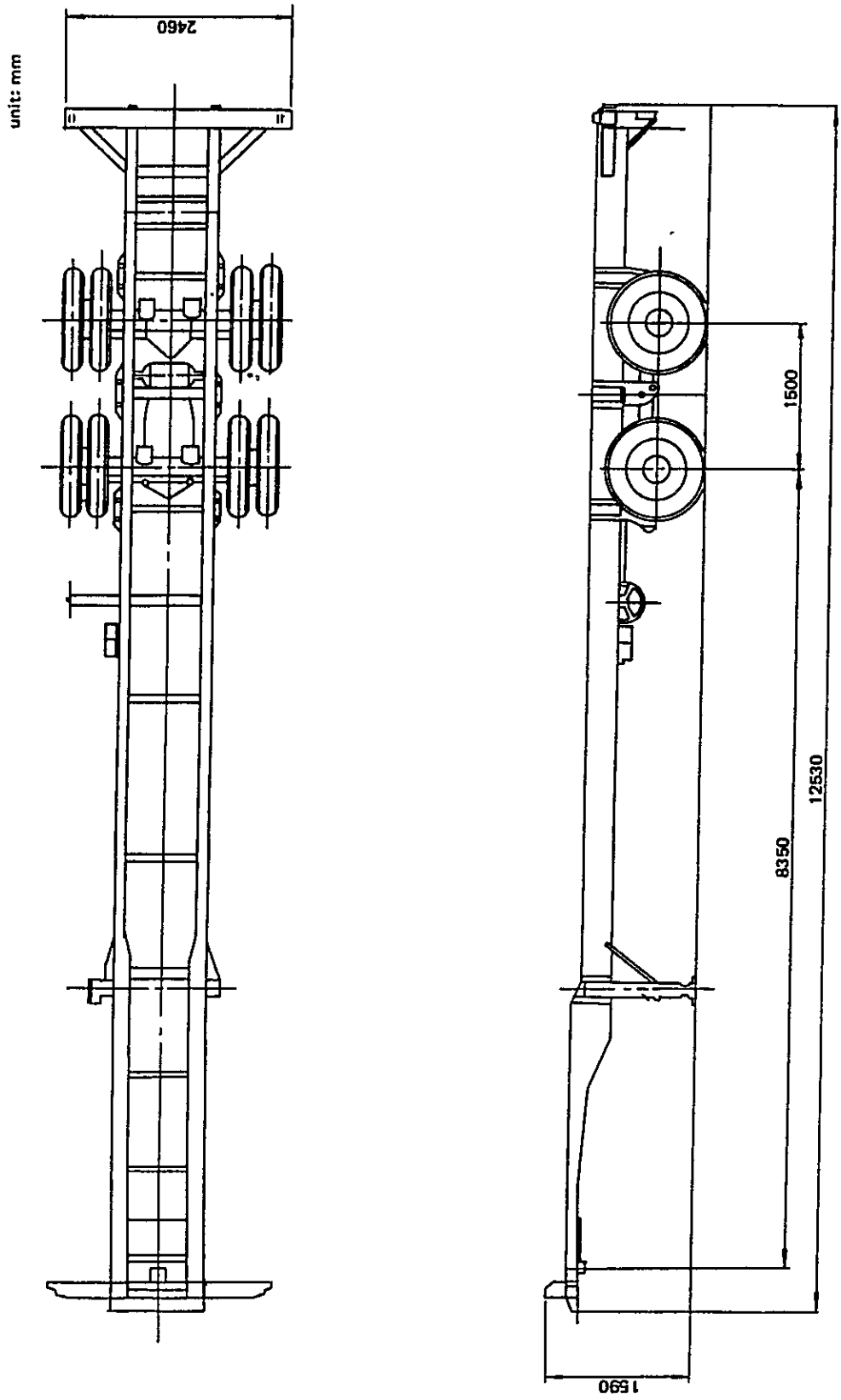


Fig. 3-5 Chassis for 40' Sea Container

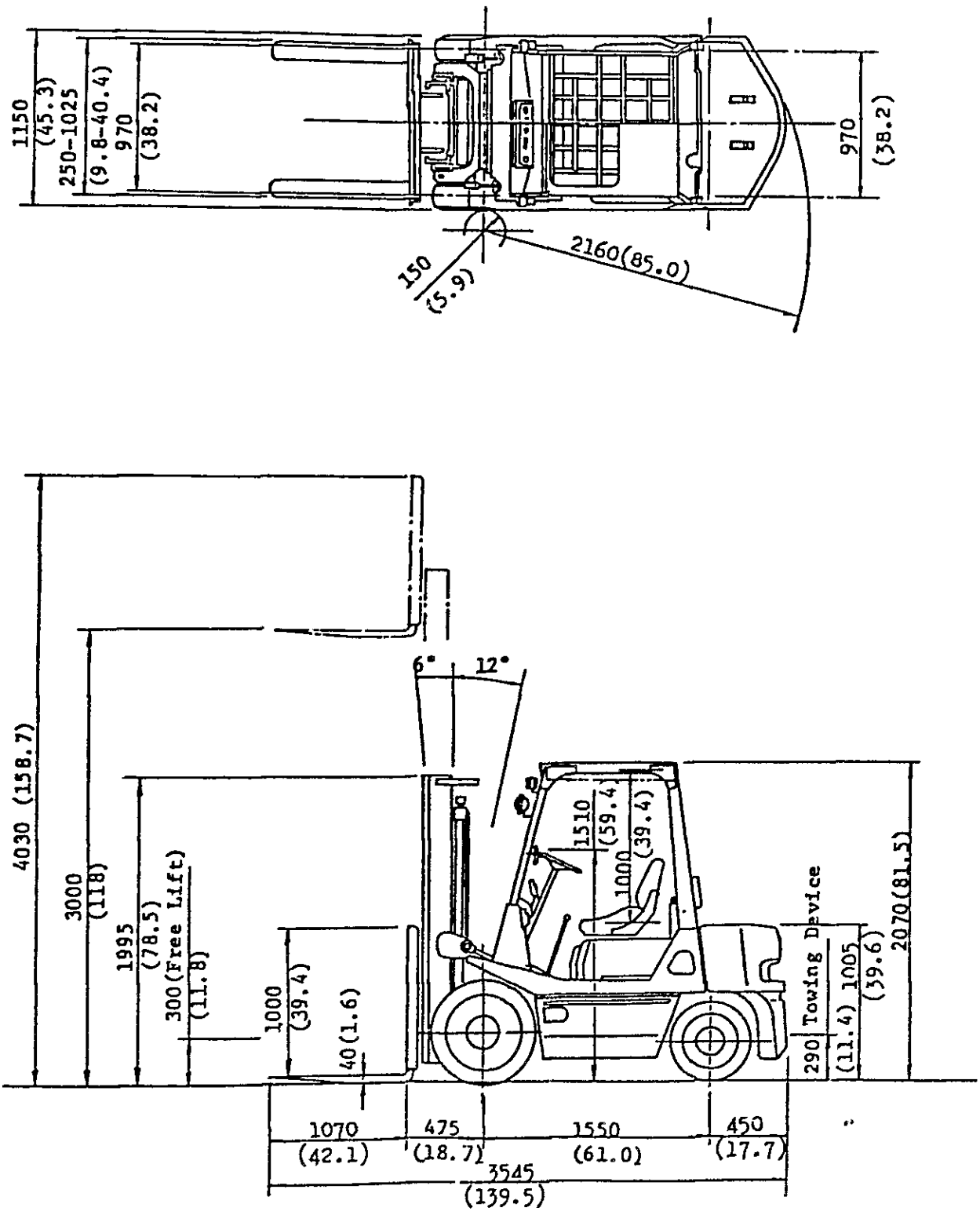


Fig. 3-6 FORK LIFT TRUCK (Small-size)

Type	:	Mechanical type, out door use
Capacity	:	50 MT
Min. Graduation	:	50 kg
Accuracy	:	1/1,000 (Full scale)
Plat form dimension	:	18,000 mm x 3,500 mm
Power source	:	AC 100 V (±10%) 60 Hz

unit: mm

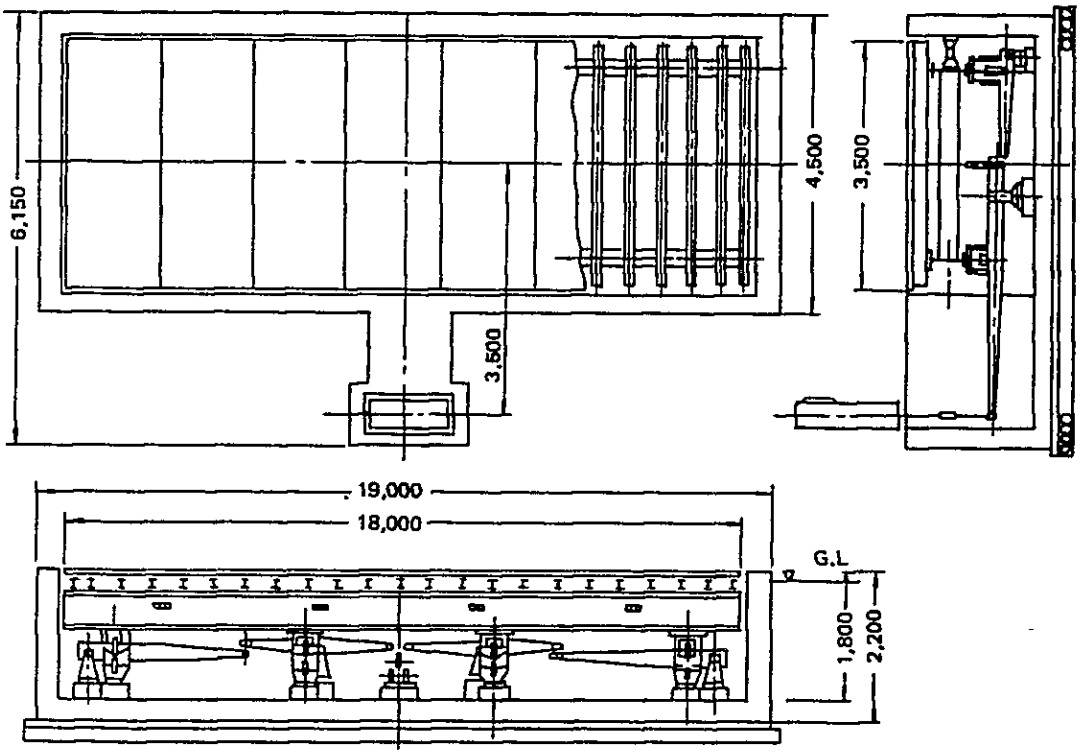


Fig. 3-7 Truck Scale

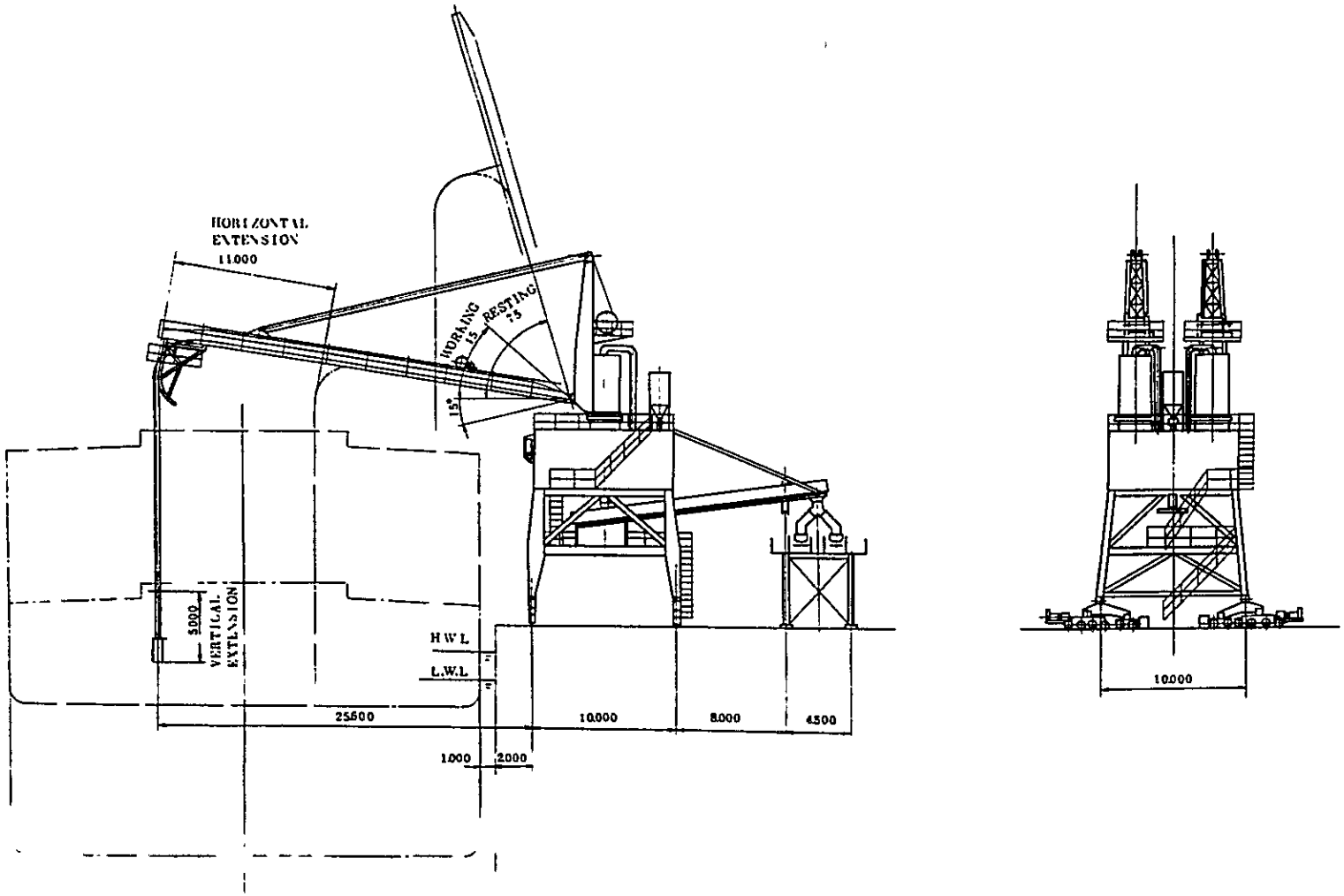


Fig. 3-8 400 t/h PNEUMATIC UNLOADER

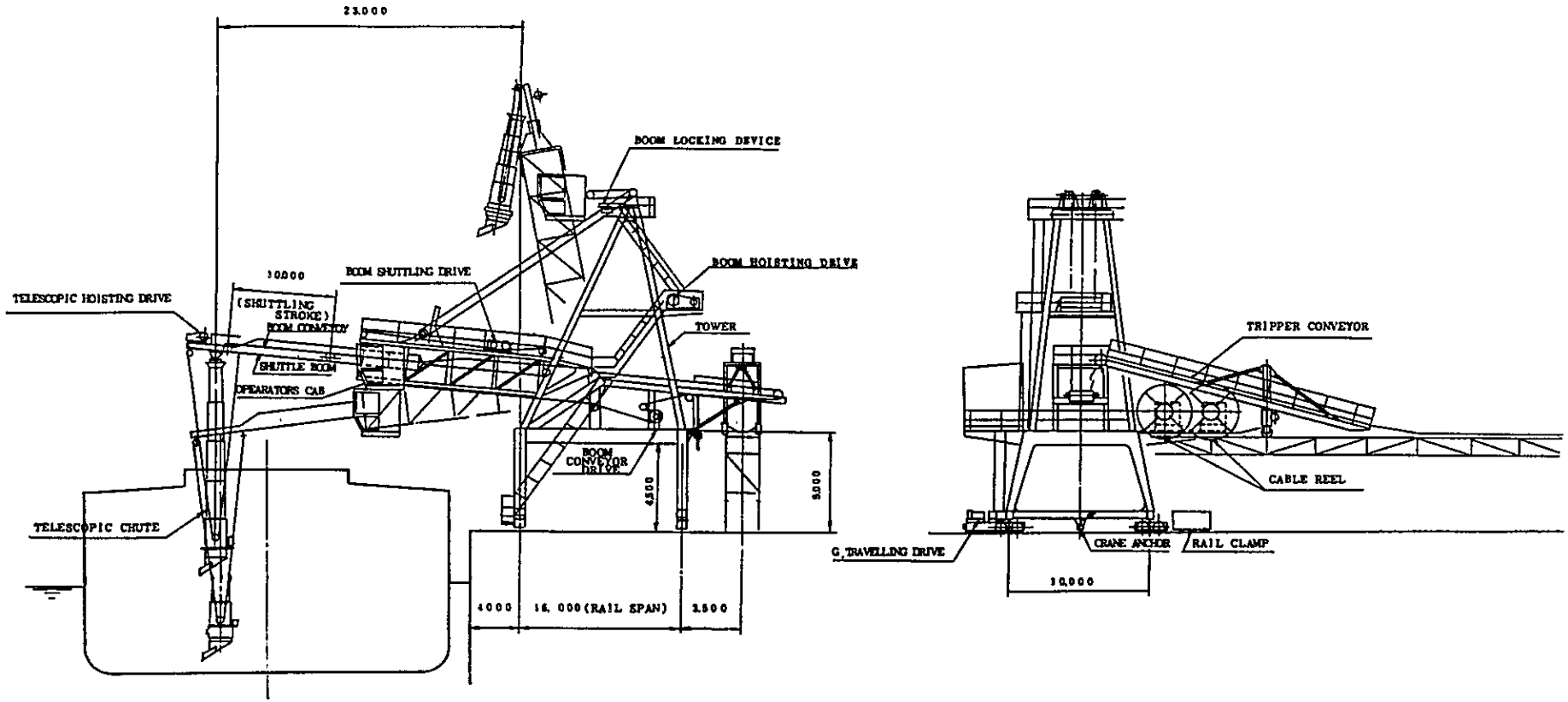


Fig. 3-9 800 t/h SHIP LOADER